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December 01, 2004

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APPLICATION NUMBER: *60/512,714*
FILING DATE: *October 20, 2003*
RELATED PCT APPLICATION NUMBER: *PCT/US04/34656*

Certified by

Jon W Dudas

Acting Under Secretary of Commerce
for Intellectual Property
and Acting Director of the U.S.
Patent and Trademark Office

PROVISIONAL APPLICATION COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION under 37 CFR 1.53(b)(2).

Docket Number: TIMK 8791US

INVENTOR(s)/APPLICANT(s)

LAST NAME	FIRST NAME	MIDDLE INITIAL	RESIDENCE (CITY AND EITHER STATE OR FOREIGN COUNTRY
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TITLE OF THE INVENTION (280 characters max)

CLUTCHING DEVICE

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Express Mail No. EL 993297230 US

ENCLOSED APPLICATION PARTS (check all that apply)

☒ Specification Number of pages [4] ☒ Drawings Number of sheets [2]
☒ Claims Number of pages [1] ☐ Claiming Small Entity Status

METHOD OF PAYMENT

A check or money order in the amount of:

☒ $160.00 for large entity
☐ $80.00 for small entity

is enclosed to cover the Provisional filing fees.

The Commissioner is hereby authorized to charge any additional fees or credit overpayment under 37 CFR 1.16 and 1.17 which may be required by this paper to Deposit Account 162201. *A duplicate copy of this sheet is enclosed.*

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

☒ No
☐ Yes, the name of the Government Agency and the Government Contract Number are:

Respectfully submitted,

Edward A. Boeschenstein, Reg. No. 22,986 Date: 10-20-03

Express Mail No. EL 993297230 US

EXPRESS MAIL FILING CERTIFICATE

RE: U.S. Provisional Patent Application
TITLE: **CLUTCHING DEVICE**
INVENTOR: Mark A. Joki

I hereby certify that this U.S. Provisional Patent Application is being deposited with the United States Postal Service utilizing the "Express Mail Post Office to Addressee" service addressed to Mail Stop Provisional Patent Application, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on October 20, 2003.

Edward A. Boeschenstein,
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10-20-03
Date of Signature

Express Mail No. EL 993297230 US

CLUTCHING DEVICE

Background

US patent 6,409,001 discloses a clutching device that can selectively couple a gear to a shaft. This device requires a number of parts that are needed to engage and disengage the clutch. This invention explains a novel actuation method that requires no ancillary parts for actuation. This invention allows replacing a cone type synchronizer device with a much lower cost and narrower device.

Description of the Drawings

Figure 1 is a longitudinal sectional view of a gear pair with synchronizers mounted on a shaft as in a manual transmission. A conventional cone synchronizer is below the centerline and the synchronizer of this invention above the centerline; and

Figure 2 is a fragmentary end view of the gear, synchronizers, and shaft taken along line 2-2 of Fig. 1 with the synchronizer being disengaged.

Description of the Preferred Embodiments

Referring to bottom half of figure 1, which is the conventional synchronizing method, a small gear, 1, and a larger gear, 2, are rotatably mounted on shaft, 3. To couple the shaft, 3, to the small gear, 1, which is rotating at a different speed than the shaft, 3, a shift fork, 6, is moved towards the small gear, 1. The shift fork, 6, pushes against ring, 7, which is rotationally fixed

to shaft, 3, but axially moveable. The inner teeth dge of ring, 7, contact and drive outer cone member, 5, which in turn, contacts and applies rotational torqu to the inner cone member, 4, which is rotationally fixed to the small gear, 1. The profile on the edge of inner teeth of ring, 7, and the edge of outer teeth on outer cone member, 5, block further axial movement of ring, 7, while accelerating torque is being transferred from ring, 7, to outer cone member, 5. When the small gear, 1, is approximately the same speed as the shaft, 3, there is no longer significant accelerating torque transmitted and the ring, 7, is no longer axially blocked by the outer cone member, 4, allowing it to axially move to engage the outer teeth of inner cone member, 4, which rotationally fixes the small gear, 1, to the shaft, 3.

Referring to the top half of figure 1, which embodies this invention, a tubular slipper, 8, is loosely fit over shaft, 3. The inner periphery of the tubular slipper, 8, forms a cylindrical frictional surface. The outer periphery of the tubular slipper, 8, has a bearing surface with radial projections forming a series of axial recesses as described in US 6,409,001. The tubular slipper, 8, is not fully circular but has an axial gap to facilitate radial contraction. A coupling member, 9, has a cylindrical outer periphery press-fit into the small gear, 1. The inner cylindrical surface of the coupling member, 9, has a bearing surface with radial projections forming a series of axial recesses in a similar pattern to the tubular slipper, 8. Rollers, 11, are placed between the radial gap between the tubular slipper, 8, and the coupling member, 9 – indeed, in the recesses in the tubular slipper, 8, and the coupling member, 9. On one end of both the tubular slipper,

8, and the coupling member, 9, is formed first radial flanges with rotationally interlocking features, 12, which can be the form of internal and external involute splines. When the interlocking features, 12, are engaged, the recesses in the tubular slipper, 8, and the recesses in the coupling member, 9, are substantially radially opposed, creating looseness of the rollers, 11, between these two members. A second radial flange, 13, on the coupling member, 9, traps the rollers, 11, and a wave spring, 10, keeps the rollers, 11, seated against the first radial flange of the coupling member, 9, which contains one part of the interlocking features, 12. A second radial flange, 14, on the tubular slipper, 8, traps the rollers, 11, and the wave spring, 10, keeping the rollers, 11, seated against the first radial flange of the tubular slipper, 8, which contains another part of the interlocking features, 12. In this condition, the tubular slipper, 8, is loose on the shaft, and very little torque transfers between the small gear, 1, and the shaft, 3. When driving through the small gear, 1, is desired, the shift fork, 6, pushes the small gear, 1, to the left, causing the coupling member, 9, to move with it. The interlocking features, 12, disengage from each other. The small gear, 1, driven, moves relative to the shaft, 3, and experiences a slight drag from the contact of the tubular slipper, 8, on the shaft. The drag torque causes the tubular slipper, 8, to move relative to the coupling member, 9, causing the rollers, 11, to contact the sides of the recesses, causing the tubular slipper, 8, to reduce in diameter, which increases the drag torque. The high pressure angle of the contact of the rollers with the sides of recesses, causes the tubular slipper, 8, to lock on the shaft and power is transferred from the small gear, 1, to the shaft, 3,

by the friction caused by the high normal forces of the tubular slipper, 8, on the shaft, 3.

Claims

1. A clutching device comprising a tubular slipper, a coupling member, and rollers, said tubular slipper having a cylindrical friction surface and a generally cylindrical bearing surface, said bearing surface having radial projections which form axially oriented recesses, one end of said tubular slipper having a radially directed flange characterized by at least one feature capable of rotatably positioning said tubular slipper, said coupling member having a cylindrical mounting surface and a generally cylindrical bearing surface, said bearing surface having radial projections which form axially oriented recesses, one end of said coupling member having formed a radially directed flange characterized by at least one feature capable of rotatably positioning said coupling member, said recesses of tubular slipper and said recesses of coupling member forming pockets in which said rollers are located, said feature on the flange of tubular slipper being able to both engage said feature on the flange of the coupling member or by relative axial motion, disengage said features.

2. A device according to claim 1 in which both the tubular slipper and the clutching member each have radial flanges at both ends which axially contain the rollers and an axially acting spring such that the spring holds the cooperating flange features engaged with each other, rotationally aligning the tubular slipper to the coupling member when no external forces are applied to the device.

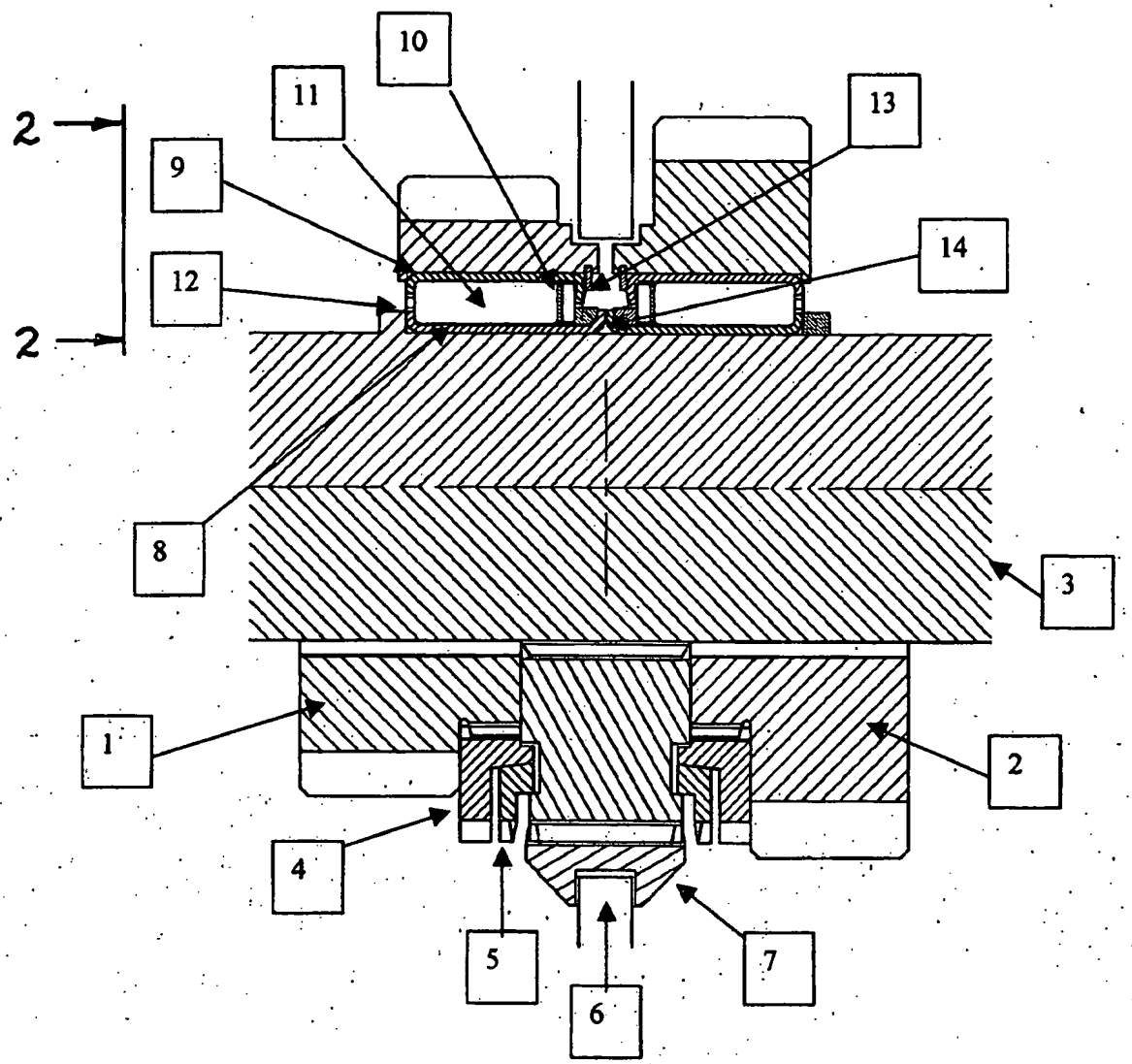

Figure 1

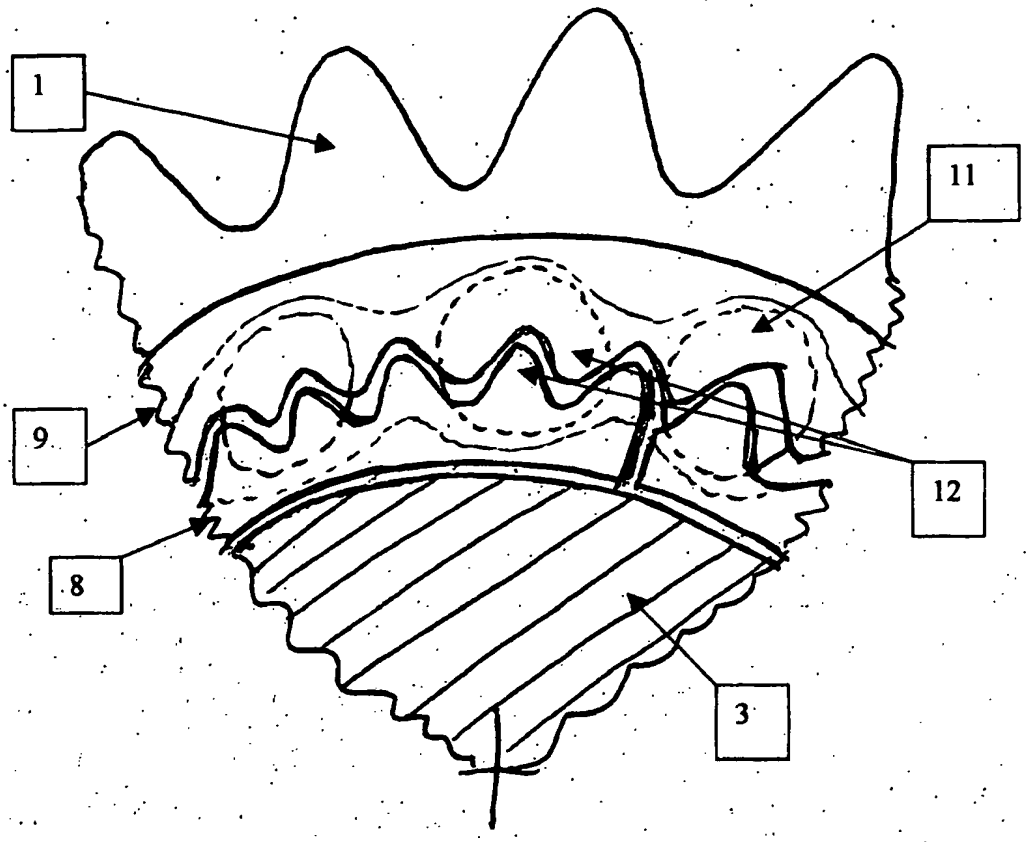

Figure 2

Document made available under the Patent Cooperation Treaty (PCT)

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